Weed Suppression with Cereal Cover Crops

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Abstract

Experiments were conducted under rain-fed conditions at Lethbridge, Alberta to determine the effect of short-term fall rye (*Secale cereale* L.), winter wheat (*Triticum aestivum* L.) and no cover crop treatments in the fallow year on weed growth. Under favorable weather conditions fall rye was as effective as post-harvest plus early spring tillage or herbicides in spring weed control. Winter wheat and fall rye residues, after growth was terminated in June, reduced weed biomass in September by 50% compared to no cover crop in 1993 but had little effect on weeds in 1995. A fall rye cover suppressed annual sow-thistle, flixweed, stinkweed, foxtail barley, Canada thistle and dandelion but not thyme-leaved spurge and downy brome. Wheat initially suppressed weed growth but did not have a long-term effect on as many weed species.

Keywords: allelopathy, cover crop, fall rye, weed control and winter wheat.

Introduction

Cover crops traditionally have been grown for soil and water conservation and not for immediate economic gain (Odland and Knoblauch 1938; Kessavalou and Walters 1997). There are indications that live cover crops and their residues can suppress weed growth. DIBOA (2,4-dihydroxy-1,4-benzoxin-3(4H)-one) occurs in fall rye and is an allochemical that seems to suppress the growth of some plants, insects and fungi (Niemeyer 1988; Yenish et al. 1995). The objective of this study was to determine the effect of short-term cover crops in a fallow year on subsequent weed growth.

Materials and Methods

Experiments that included fall rye (FRYE), winter wheat (WWHT) and no cover crop (NCOV) were established in Sept. 1992 and 1994. Weeds were controlled on the NCOV plots with 2,4-D and glyphosate/dicamba in October and April after the cover crops were established. In each experiment the cover crops were killed the following June at the beginning of anthesis. The following treatments were used: 1) glyphosate at 440 g a.e./ha + Agral 90 at 0.5%, crop left standing (GLY-ST), 2) glyphosate at 440 g a.e./ha + Agral 90 at 0.5%, crop crushed flat on to the soil surface (GLY-RO), 3) Noble wide-blade cultivator at a depth of 7.5 to 10 cm, crop crushed flat on to the soil surface, 4) offset disc at a depth of 7.5 to 10 cm (DISC). In the fallow year,

weed biomass was measured before crops were killed in June and weed counts plus biomass were taken in September. Weeds were counted in April before application of glyphosate/dicamba and in June after seeding wheat.

Results

Weed and cover crop biomass. Rye produced more biomass than wheat in all years. Cover crops seeded in 1994 produced only about 65% of the biomass that was produced by the 1992 crops. The 1994 cover crops had little effect on weed biomass. In 1993, weed biomass in June, mainly flixweed, stinkweed and kochia, was similar in FRYE and NCOV (Table 1). NCOV received a fall application of 2,4-D and a spring application of glyphosate/dicamba. In September the lowest weed biomass occurred in GLY-ST/FRYE or WWHT (Table 1). NCOV weed biomass was double that in FRYE or WWHT where a similar killing treatment was used.

Table 1. Crop and Weed Biomass (g/m^2) in June and Weed Biomass in September of the 1993 Fallow Year.

Cover Crop	Killing method	Crop June	Weed June	Weed Sept.
FRYE	GLY-ST	515a	8b	30c
	GLY-RO			56b
	NOBLE			67b
	DISC			100ab
WWHT	GLY-ST	358b	23a	24c
	GLY-RO			67b
	NOBLE			74b
	DISC			89ab
NCOV	GLY-ST	0c	12b	73b
	GLY-RO			111a
	NOBLE			142a
	DISC			124a

a-c Means within a column that are followed by the same letter are not significantly different by the protected LSD test (P<=0.05)

Weed populations after cover crops were killed. Both the cover crop and the method of killing the cover crop influenced weed populations. In September, dandelion density was lowest in the FRYE treatment while thyme-leaf spurge density was lower in NCOV than FRYE or WWHT (Fig.1). Wild oat and redroot pigweed density tended to be lowest in GLY killing treatments but dandelion and foxtail barley were lowest in the DISC treatment. In April after fallow, densities of weeds such as annual sow thistle, stinkweed, foxtail barley and flixweed were lower in FRYE than NCOV while the lowest downy brome density was in the NCOV treatment (Fig 2). In a wheat crop the following June, Canada thistle and dandelion densities were lower after FRYE than NCOV (Fig. 3). The DISC killing treatment resulted in the lowest Canada thistle density.

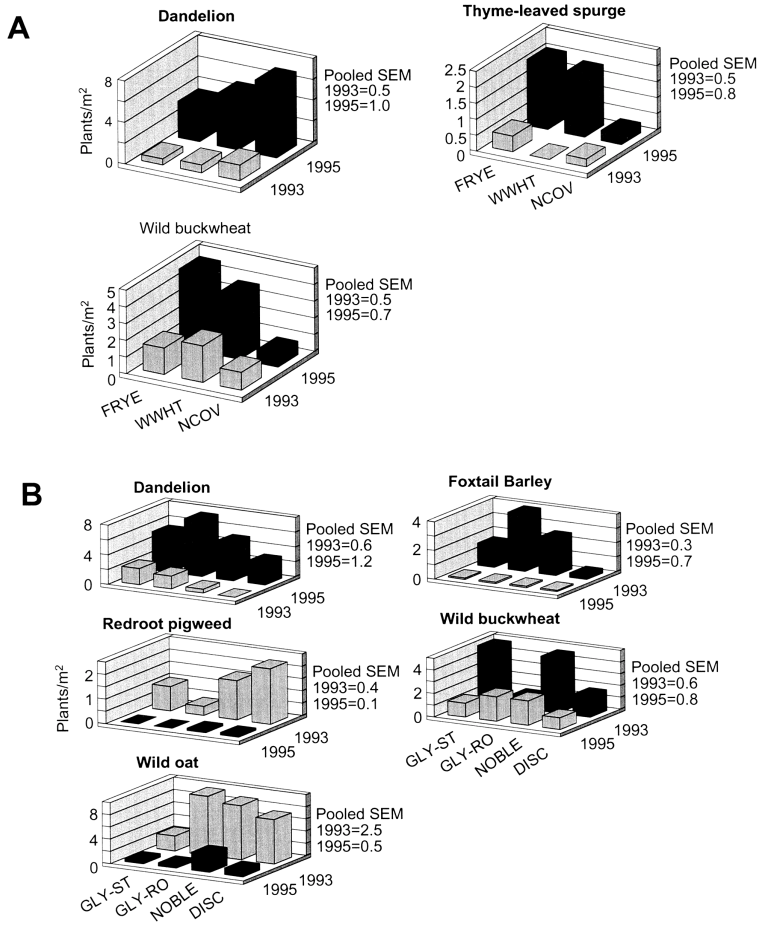

Figure 1. Weed densities in September of the fallow year. A) Effect of cover crop treatment. B) Effect of cover crop killing treatment.

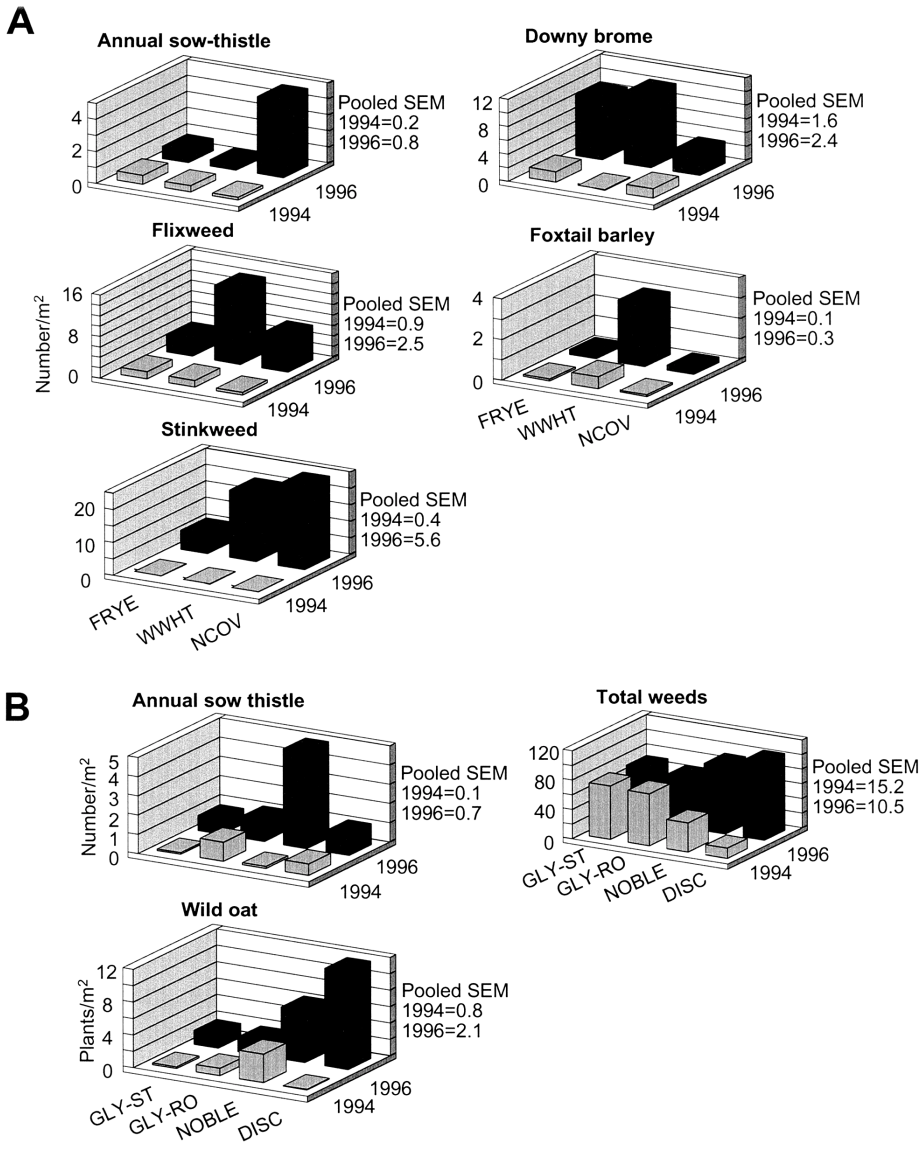

Figure 2. Weed densities in April after the fallow year. A) Effect of cover crop treatment. B) Effect of cover crop killing treatment.

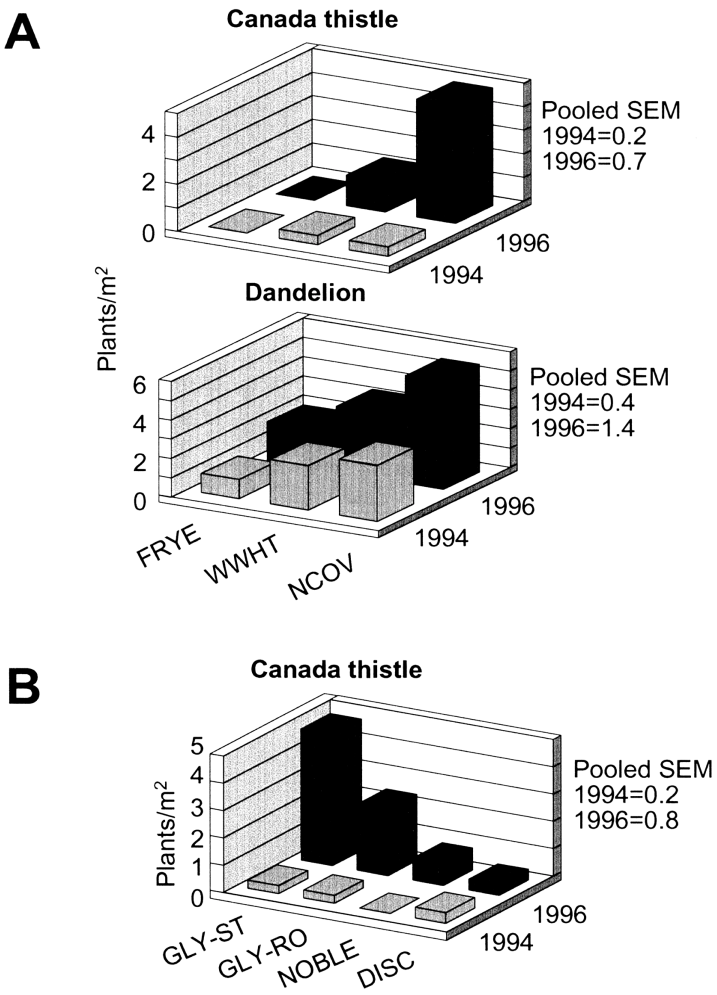

Figure 3. In crop weed densities in June in the wheat crop before herbicide application. A) Effect of cover crop treatment. B) Effect of cover crop killing treatment.

Acknowledgement

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